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AFPEA REPORT NO. 94-R-01
AFPEA PROJECT NO. 91-P-101

ROBERT S. TEKESKY

Mechanical Engineer

DSN 787-3362
Comm. (513) 257-3362

Development of the Family of Munitions Container #2 for Small Miscellaneous Munitions CMU 533/E

AFMC-LSO/LGTP
PACKAGING BRANCH
5215 THURLOW ST BLDG 70
WRIGHT-PATTERSON AFB, OH 45433-5540

October 1994

PROJECT: 91-P-101
TITLE: Family of Munitions Container #2

ABSTRACT

An OO-ALC/MMW (presently OO-ALC/LIWDT) Process Action Team (PAT) came up with the idea to have a Family of Munitions Containers (FMC) of three to six containers to replace most of the Air Force's 200 munitions containers. OO-ALC realizing the potential of this idea initiated Productivity, Reliability, Availability, Maintainability (PRAM) project 21989-01. This report will deal with FMC number two (FMC #2), which is designed for fuses, boosters, and other miscellaneous munitions. The container is a two person carrying container with a gross weight of 150 lb. AFPEA's role was to design, fabricate, test and provide a Production Drawing Package to OO-ALC/LIWDT.

FMC #2, (CNU 533/E) is a welded aluminum, controlled breathing, reusable container. The container is constructed out of two aluminum extrusions and sheet aluminum for the top and bottom. The container has a cam-over-center latch, desiccant port, pressure relief valve, humidity indicator, air filling valve, and silicone rubber gasket to seal the container. Stacking pads are located on top of the container for easy lock-in-place stacking. Palletized loads are made easier with this container's stackability. The containers external finish is bare aluminum. This cuts cost in painting and maintaining the container and reduces adverse environmental impact caused by painting.

MAN-HOURS: 1103

PUBLICATION DATE: 04 OCT 1994

PREPARED BY:
ROBERT S. TEKESKY
Mechanical Engineer
AF Packaging Eval. Activity

REVIEWED BY:
TED HINDS
Supervisor, Design Group
AF Packaging Eval. Activity

APPROVED BY:
LESLIE K. CLARKE, III
Chief, AF Packaging
Evaluation Activity

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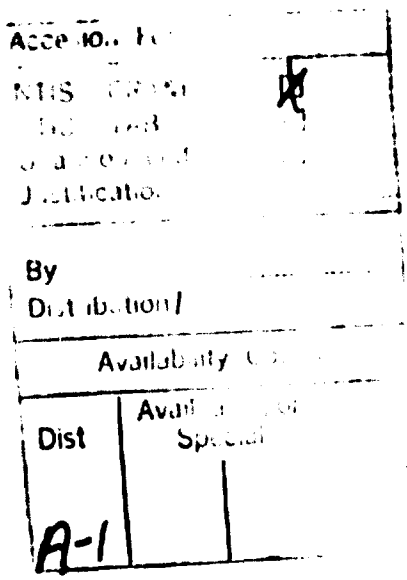

INTRODUCTION:

BACKGROUND:
An OO-ALC/MMW (presently OO-ALC/LIWDT) Process Action Team (PAT) came up with the idea to have a Family of Munitions Containers (FMC) of three to six containers to replace most of the Air Force's 200 munitions containers. OO-ALC realizing the potential of this idea initiated Productivity, Reliability, Availability, Maintainability (PRAM) project 21989-01. This report will deal with FMC number two (FMC #2), which is designed for fuses, boosters, and other miscellaneous munitions. The container is a two person carrying container with a gross weight of 150 lb. AFPEA's role was to design, fabricate, test and provide a Production Drawing Package to OO-ALC/LIWDT.

REQUIREMENTS:
AFPEA in union with OO-ALC/LIWDT developed a Statement of Work (SOW) for the design of the FMC. This was the tailoring of MIL-C-5584D. The SOW, called the Design Criteria for Family Group of Munitions Containers is attached in Appendix 1.

DESIGN:

CONFIGURATION:

The container is the Shipping and Storage Container CNU 533/E. This is a welded aluminum, controlled breathing, reusable container. The container is constructed out of two aluminum extrusions and sheet aluminum for the top and bottom. The container has a cam-over-center latch, desiccant port, pressure relief valve, humidity indicator, air filling valve, and silicone rubber gasket to seal the container. Stacking pads are located on top of the container for easy lock-in-place stacking (see Appendix 3, figure 1). Palletized loads will be made easier with this container's stackability. The containers external finish is bare aluminum. This cuts cost in painting and maintaining the container and reduces adverse environmental impact caused by painting.

TESTING:

TEST SPECIMEN:
AFPEA fabricated two CNU 533/E prototype containers in house for testing (see Appendix 3, figure 1). The prototype containers were fabricated IAW all the requirements and tolerances of the container drawing package. The same drawing package that will be released for the manufacture of production quantities of the container.

TEST PLAN:
The test plan was designed, (IAW the Design Criteria for Family Group of Munitions Containers, MIL-C-5584, MIL-STD-648 and FED-STD-101), to qualify the CNU 533/E for transportation and storage in a world-wide environment. The test plan includes all test

procedures, test equipment, and pass/fail performance criteria. See Appendix 2 for the complete test plan.

CONCLUSION:

The prototype container passed all the tests with one exception. The handles used for carrying the container were tested to meet hoisting rings criteria per MIL-C-5584. The test requires the handles to hoist 5 times the weight of the loaded container. As the container was starting to lift, the handles started to show signs of deformation. The load was decreased 2 times the weight of the loaded container plus an additional 50 lb. The container was then lifted with no deformation to the handles.

The container was lifted with 5 times the weight of the loaded container. This was an unofficial test to actual see what the extent of damage the handles would receive. The bending of the physical stop on the handles was the only deformation. The handle, itself, did not fail in a catastrophic manner which would endanger personnel safety or the item. The integrity of the handle and container was maintained. However, IAW MIL-C-5584 the handle test was a failure. Therefore, AFPEA recommended to OO-ALC LIWDT to waive the handle pull test requirement. OO-ALC LIWDT accepted the recommendation and waived the test requirement.

APPENDIX 1

DESIGN CRITERIA
FOR
FAMILY OF MUNITIONS CONTAINERS

28 Aug 91

DESIGN CRITERIA

FOR

A FAMILY OF MUNITIONS CONTAINERS

1. The Air Force Packaging and Evaluation Agency (AFPEA) will design three specific containers following the applicable military standards for container design requirements as well as user and program manager in puts. The below listed sizes have been determined by the program manager along with specific design specifications as listed in the following paragraphs.

	INTERNAL DIMENSIONS			
SIZE	LENGTH	WIDTH	HEIGHT	ITEM MAX WEIGHT
1	12	8	9	25 lb.
2	20.5	16.5	14	150 lb. CNTR GROSS WT.
3	49	38	33	675 lb.
* 4	100	39	26	2,000 lb.
** 5	180	45	23	Unknown

* Use CNU-411/E for this container.
** Use the new AUR missile container.

2. These containers will be designed for the maximum load weight and/or items in each container as indicated:

SIZE	ITEM
1	Design to maximum content weight.
2	Design to maximum content weight.
3	BSU 49/50 and MXU 650 Airfoil Group.
4	Use CNU-411 container for CBU 87/89, SUU 30-type, Mk 20, and similar type/size CBU munitions.
5	Use CNU 407 type container for all present and or future air to air missiles or other air munitions.

3. The Family of Munitions Containers shall be designed in accordance with MIL-C-5584D and options in MIL-C-5584.

A. Par. 1.2; Classification.

Sizes 1, 2, 4, and 5 Type II - Horizontal Mount

Size 3 Type I - Vertical Mount

B. Par. 3.2; First article. One container of each size (1, 2, and 3) shall be provided for first article testing, for each container design. A second container of each design shall be provided after completion of first article testing.

C. Par. 3.4; Design and construction. These containers shall be designed in metric units in accordance with Public Law 94-168, as amended by Public Law 100-418.

D. Par. 3.4.2.2; Cure date on shock isolation system. This applies to rubber products only.

E. Par. 3.4.3.1; Desiccant receptacle. Container sizes 2 and 3 shall have desiccant receptacles. Container 1 would not have a desiccant receptacle because of its small size. If required, desiccant can be placed inside container 1 by removing the cover then resealing.

F. Par. 3.4.3.2; Humidity indicator. A humidity indicator shall be provided on sizes 2 and 3. Note: A humidity indicator card may always be placed inside container size 1.

G. Par. 3.4.3.3; Pressure equalizing valve. All containers shall have a pressure relief/equalizing valve, with the following characteristics:

Cracking Pressure = 1.0 to 1.5 PSID
Full Open Pressure = 2.5 PSID
Reseal Pressure $\geq$ 0.5 PSID

Minimum Flow Rate (cubic feet/minute) = Vc * (0.12)
Vc = Volume of the Container (cubic feet)
Ref. MIL-V-27166, Par. 3.6.3

H. Par. 3.4.3.4; Visual inspection ports. N/A

I. Par. 3.4.3.5; Air filling valve. An air filling valve will be provided on containers 1, 2, and 3.

J. Par. 3.4.3.6; Record receptacle. N/A

K. Par. 3.4.3.7; Drain plug. N/A

L. Par. 3.4.3.8; Fuel leak detector. N/A

M. Par. 3.4.4; Handling provisions. Investigate the use of spring loaded handles on container 1.

N. Par. 3.6.1; Item testing/inspection. N/A

O. Par. 3.6.2; Item uploading. N/A

P. Par. 3.6.3; Installation time. N/A

Q. Par. 3.6.5; Shock transmission. Container 3, BSU 49, 50 and MXU 650 fins, require physical and mechanical protection only. The other container designs require testing to the maximum weight, therefore, shock transmission is not a concern.

R. Par. 3.6.5.1; UN drop test. Container sizes 1 and 2 shall be tested to category A, at the maximum weight, unless actual items are used.

S. Par. 3.6.8; Size and weight. The containers shall be designed to the internal sizes and for the weights specified in paragraphs 1 and 2 above.

T. Par. 3.9.1; Aluminum. The container shall be treated as defined in 1 below. An alternate method of finishing aluminum products shall be as specified in 2 below.

(1) The exterior of the container shall be bead blasted with plastic media. NOTE: this is pending MAJCOM's approval.

(2) The painting of aluminum shall be as follows:

Aluminum surfaces shall be cleaned, pretreated, primed and painted in accordance with MIL-STD-171E. Cleaning shall be in accordance with Finish 5.2, MIL-STD-171E. The container shall have an immersion cleaning in accordance with TT-C-490C(1), Method III, Type III, then rinsed, followed by a force drying. This shall be followed by a spray application of wash primer DOD-P-15328D(1). Priming and finish shall be in accordance with Finish 20.9, MIL-STD-171E, see Section 5.3 of MIL-STD-171E. The primer used shall meet the requirements of MIL-P-23377F, followed with two (2) coats of topcoat TT-E-515A(1).

U. Par. 3.12; Installation instructions. N/A

V. Par. 4.7.7.1 & 4.7.7.2; Vibration tests will not be conducted unless the actual/dummy load is being tested. When testing to a maximum weight per container vibration tests will not be required.

W. Para. 4.7.5.2; Latch strength for containers 1 and 2 shall be 500 lb.

APPENDIX 2

TEST PLAN

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Contianer Test Plan)

AFPEA PROJECT NUMBER: 91-P-101

CONTIANER SIZE (L x W x D) (MILLIMETERS) INTERIOR:	EXTERIOR:	WEIGHT (Kgs) GROSS:	ITEM:	CUBE (CU. M)	QUANTITY:	DATE:
	598 x 505 x 394	68.0		0.12	1	15 JAN 92

ITEM NAME: Family of Munitions Container No. 2

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-533/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container, Test load of wood and misc. items, (Gross wt. 68.0 Kg (150 lbs.))

CONDITIONING: As noted below

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
1.	Examination of Product.			
	(4.7.1)* (4.8)	The container/drawings shall be examined to determine conformance with the materials, design, Table I of MIL-C-5584, applicable drawings and SOW dated 28 Aug 91.	Fully assembled container.	Visual Inspection (VI)
2.	Weight Test.			
	(4.7.10)	Total container weight shall not be greater than 27 Kg (60 lbs).	Fully assembled container.	Scale
3.	Form and Fit Test.			
	(4.7.3)	The container shall be inspected for proper form and fit. Operation of the closure fasteners, handles, and the service and maintenance facilities shall be accomplished. The lid shall be removed, rotated 180°, placed back on the container and the latches fasten.	Ambient temp.	VI
4.	Leak Test.			
	FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 PSI and vacuum retention at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply/vacuum pump.	Water manometer or pressure transducer

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Contianer Test Plan)

AFPEA PROJECT NUMBER: 91-P-101

NTIANER SIZE (L x W x D) (MILLIMETERS) INTERIOR:	EXTERIOR:	WEIGHT (Kgs) GROSS:	ITEM:	CUBE (CU. M)	QUANTITY:	DATE:
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CONTAINER COST:

CK DESCRIPTION: uminum Container, Test load of wood and misc. items, (Gross wt. 68.0 Kg (150 lbs.))

NDITIONING: s noted below

ST).	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
5.	Rough Handling Tests (Lo Temperature -20 Degrees F).			
	FED-STD-101 Method 5007.1 (4.7.7.2.4) (4.7.8)	Free fall drop test. Condition at -20° F for not less than 24 hours. Drop height 457 mm (18 inches). A loaded container of 68 Kg (150 lbs) gross weight shall be used.	Procedure A, One drop on each flat face, edge, and corner. (26 drops)*	VI
6.	Leak Test.			
	FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply.	Water manometer or pressure transducer
7.	Rough Handling Tests (High Temperature +160 Degrees F).			
	FED-STD-101 Method 5007.1 (4.7.7.2.4) (4.7.8)	Free fall drop test. Condition at +160° F for not less than 24 hours. Drop height 457 mm (18 inches). A loaded container of 68 Kg (150 lbs) gross weight shall be used.	Procedure A, One drop on each flat face, edge, and corner. (26 drops)**	VI

OMMENTS:
These drops are opposite of those covered in test 7.
* These drops are opposite of those covered in test 5.

EPARED BY: Robert Tekesky, Mechanical Engineer

APPROVED BY: Ted Hinds, Chief, Design Group, AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Contianer Test Plan)

AFPEA PROJECT NUMBER: 91-P-101

CONTIANER SIZE (L x W x D) (MILLIMETERS) INTERIOR:	EXTERIOR:	WEIGHT (Kgs) GROSS:	ITEM:	CUBE (CU. M)	QUANTITY:	DATE:
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CONTAINER NAME: CNU-533/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container, Test load of wood and misc. items, (Gross wt. 68.0 Kg (150 lbs.))

CONDITIONING: As noted below

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
8.	Leak Test. FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply.	Water manometer or pressure transducer
9.	Repetitive Shock. MIL-STD-648 Para. 5.2.2 FED-STD-101 Method 5019.1 (4.7.7.3)	Test for not less than two hours as stated in FED-STD-101 Method 5019.1 Para. 6.3.	Ambient.	VI
10.	Leak Test. FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply.	Water manometer or pressure transducer
11.	Superimposed Load. MIL-STD-648 Para. 5.7.2 FED-STD-101 Method 5016.1 (4.7.6.1)	Prescribed load (W) shall be applied to the top of the container, in a manner simulating the stacking of similar containers. This load shall remain for a minimum of one hour. W = 1,542 Kg (3,400 lbs)	Ambient, on a flat, level, rigid floor.	VI, record changes, i.e. buckling, deformation

COMMENTS:

PREPARED BY: Robert Tekesky, Mechanical Engineer

APPROVED BY: Ted Hinds, Chief, Design Group, AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Contianer Test Plan)

AFPEA PROJECT NUMBER: 91-P-101

CONTIANER SIZE (L x W x D) (MILLIMETERS) INTERIOR:	EXTERIOR:	WEIGHT (Kgs) GROSS:	ITEM:	CUBE (CU. M)	QUANTITY:	DATE:
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ITEM NAME: Family of Munitions Container No. 2

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-533/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container, Test load of wood and misc. items, (Gross wt. 68.0 Kg (150 lbs.))

CONDITIONING: As noted below

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
12.	Leak Test.			
	FED-STD-101 Method 5009.3 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage is allowed over a 30 minute test duration.	Test performed in ambient condition from compressed air supply.	Water manometer or pressure transducer
13.	Handle Pull Test.			
A.	MIL-STD-648 Para. 5.8.3 (4.7.4)	The container shall be loaded 5 times its gross weight and suspended in a manner that is similar to lifting the container by both set of handles. The container shall hang for 5 minutes with no damage or permanent deformation. W = 340 Kg (750 lbs)	Ambient.	Scale
B.	MIL-STD-648 Para. 5.8.5 (4.7.4)	A loaded container shall be suspended by one handle. The container shall hang for 5 minutes with no damage or permanent deformation.	Ambient.	Scale
C.	(4.7.4) Modified	At the center of a handle apply a force of 113 Kg (250 lbs) in the direction perpendicular to the side.	Ambient.	Scale
14.	Stand-Off Test.			
	(4.7.5.1)	Place load one times the cover weight on the cover. The cover shall not deform or deflect. Slide cover on the stand-offs 0.127 meters (5feet) in each direction. There shall be no damage to the sealing surface or stand-offs.	Place container cover on a concrete floor resting on the stand-offs.	VI

COMMENTS:

PREPARED BY: Robert Tekesky, Mechanical Engineer

APPROVED BY: Ted Hinds, Chief, Design Group, AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY
(Contianer Test Plan)

AFPEA PROJECT NUMBER: 91-P-101

CONTIANER SIZE (L x W x D) (MILLIMETERS) INTERIOR	EXTERIOR	WEIGHT (Kgs) GROSS	ITEM	CUBE (CU M)	QUANTITY	DATE
	598 x 505 x 394	68.0		0.12	1	15 JAN 92

ITEM NAME: Family of Munitions Container No. 2

MANUFACTURER: Prototype by AFPEA

CONTAINER NAME: CNU-533/E

CONTAINER COST:

PACK DESCRIPTION: Aluminum Container. Test load of wood and misc. items. (Gross wt. 68.0 Kg (150 lbs.))

CONDITIONING: As noted below

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
15.	Structural Pressure Test.			
A.	MIL-STD-648 Para. 5.5.2	Container shall be pressurized to +3.0 PSI. The container shall not fail in a dangerous or catastrophic manner, i.e. loss of integrety.	Ambient.	Water manometer or pressure transducer
B.	MIL-STD-648 Para. 5.5.3	Container shall be vacuum pressurized to -3.0 PSI. The container shall not fail in a dangerous or catastrophic manner, i.e. loss of integrety.	Ambient.	Water manometer or pressure transducer
16.	UN (Pop) Drop Test.			
	Title 49 Parts 100-199 1992 edition (4.7.7.2.5)	Container shall undergo UN (POP) Drop Testing. The container shall not leak or spill any of the contents. Safe disposal of the contents shall be possible. Drop height shall be 1.2 meters (47.2 inches). A different container may be used for each drop, but is not required	Ambient. A total of 5 drops, bottom, top, long side, short side, and most vulnerable corner (top).	VI

COMMENTS:

PREPARED BY: Robert Tekesky, Mechanical Engineer

APPROVED BY: Ted Hinds, Chief, Design Group, AFPEA

APPENDIX 3

QUALIFICATION TEST REPORT

KEITH A. VOSSLER

Mechanical Engineer

DSN: 787-4519

Commercial: (513) 257-4519

FAMILY OF MUNITIONS CONTAINER NUMBER 2

CNU-533/E

HQ AFMC/LGTP
AIR FORCE PACKAGING EVALUATION ACTIVITY
5215 THURLOW ST BLDG 70
WRIGHT-PATTERSON AFB OH 45433-5540

INTRODUCTION

The objective of this test series was to qualify the Family of Munitions Container Number 2, CNU-533/E, for production release by HQ AFMC/LGTP. The container passed the prescribed container test plan.

CONTAINER DESCRIPTION

The Family of Munitions container Number 2, CNU-533/E, is a small sized (under 60 pounds), sealed aluminum container for transportation and storage of miscellaneous munitions such as fuses and boosters. (Figure 1). The container consists of a cover and a base (Figure 2). Maximum outer container dimensions are 23.5 inches length, 19.9 inches width, and 15.5 inches depth.

TEST PROCEDURE

The CNU-533/E Container was tested in accordance the Air Force Packaging Evaluation Activity (AFPEA) Test Plan, Project Number 91-P-101, dated 15 Jan 92. The AFPEA Test Project Number was 92-P-114. The test plan referenced MIL-C-5584D, MIL-STD-648A, and FED-STD-101C.

The test methods constitute both the procedure for performing the tests and performance criteria for evaluation of container acceptability. The tests are commonly applied to special shipping containers providing rough handling protection to sensitive items. The tests were performed at AFPEA, HQ AFMC/LGTP, 5215 Thurlow St, Bldg 70, Wright-Patterson AFB OH 45433-5540.

Due to late delivery of the manual lift handles, the container was tested without the handles (Figure 3) and was inspected for interior and exterior damage after each test sequence. Test Sequence 13, Handle Pull Test, was performed after completion of the other test sequences when the handles were received.

CONTAINER FACE IDENTIFICATION

The correlation between numbered and designated container sides is as follows (Figure 4):

NUMBERED SIDE	DESIGNATED SIDE
1	Top
2	Forward (Desiccant Port)
3	Bottom
4	Aft
5	Left
6	Right

TEST SEQUENCES

TEST SEQUENCE 1 - MIL-C-5584D, 4.7.1, Examination of Product and 4.8, Inspection of Packaging.

A visual inspection of the container was made. The container was equipped with a pressure relief valve, Schrader 645E6 valve, humidity indicator, desiccant port, 4 cover latches, 4 manual lift handles, and 4 cover stacking pads.

Container workmanship was visually examined. The container was free of defects that would affect strength, durability, safety, or serviceability. Container welds appeared uniform and the container was smooth and free of sharp or jagged edges.

Container color, finish, marking, identification, installation instructions, and drawings were not examined. Inspection of packaging was not performed.

TEST SEQUENCE 2 - MIL-C-5584D, 4.7.10, Weight Test.

The following equipment was utilized:

EQUIPMENT	MANUFACTURER	SERIAL NUMBER	CALIBRATION EXPIRATION DATE
Scale	Howe	A057232	22 Jul 94

The container was weighted.

COMPONENT	WEIGHT (pounds)
Base	45.75
Cover	14.00
Tare Weight	59.75*

*Excludes handles.

The maximum allowable container tare weight was 60 pounds. The gross container weight was 149.75 pounds, which did not exceed the maximum allowable gross container weight of 150 pounds (reference Test Plan).

TEST SEQUENCE 3 - MIL-C-5584D, 4.7.3, Form and Fit Test.

The container closed and sealed. The pressure relief and Schrader valves, desiccant port, and latches were examined and operated.

The latch on corner 146 closed, but did not fully seat like the other latches.

TEST SEQUENCE 4 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

The following equipment and instrumentation was utilized:

EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER	CALIBRATION EXPIRATION
Digital Manometer	Yokogawa	26555-22	82DJ6009	11 Jun 93
Vacuum/ Pressure Pump	Thomas Industries	TA-0040-V	34DA72080A	N/A

The container pressure relief valve in the desiccant port was removed and the relief valve hole used for attachment of the digital manometer and vacuum/pressure pump lines. The container, with its test load, was closed and sealed. The leak tests were conducted in accordance with FED-STD-101C, Method 5009.3, at ambient temperature and pressure.

The pneumatic pressure leak technique (Figure 5) was utilized and the container pressurized to 1.5 pounds per square inch (psi). The container leak rate was 0.027 psi/hour (psi/hr) which was

less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

The vacuum retention leak technique was utilized and the container evacuated to -1.5 psi. The container leak rate was 0.04 psi/hr which was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCES 5 and 7 - FED-STD-101C, Method 5007.1, Free Fall Drop Test, MIL-C-5584D, 4.7.7.2.4, Free Fall Drop Test, and 4.7.8, Environmental Tests.

The following equipment was utilized:

EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER
Temperature/altitude Chamber	Tenney Engineering	64ST	11,830
Drop Tester	L.A.B.	AS-160	1064018

The free fall drop tests were conducted in accordance with FED-STD-101C, Method 5007.1. The container and test load (Figure 6) were conditioned at -40° F (Test Sequence 5) and +160° F (Test Sequence 7) and transported to the Conditioning Laboratory to be released from the drop tester.

The container was dropped 18 inches (Level A packaging protection) onto the drop tester steel plate. Procedure A for rectangular containers was utilized in which one drop was made on each flat face (Figure 7), edge (Figure 8), and corner (Figure 9), (total of 26 drops), with half of the drops (13) made at low temperature and half (13) at high temperature.

On the cold drops, latches 164, 125, and again 164 loosened but did not open. As latches loosened, they were closed before the next drop (reference Test Report Sequence 3).

Visual inspection revealed no damage to the latches or container.

TEST SEQUENCE 6 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description).

The container leak rate was 0.046 psi/hr when the container was pressurized to 1.5 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 8 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description except the container was tested without test load).

Immersion leak testing indicated a seam weld failure at corner 126 gasket lip of the base. The design engineer did not consider this a failure as this was a seal weld and not a structural weld. The container was repaired and pressure tested again.

The container leak rate was 0.014 psi/hr when the container was pressurized to 1.5 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 9 - MIL-STD-648A, 5.2.2, Repetitive Shock Test, FED-STD-101C, Method 5019.1, Vibration (Repetitive Shock Test, and MIL-C-5584D, 4.7.7.3, Repetitive Shock (Superimposed Loads).

The following equipment was utilized:

EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER
Vibration Machine	L.A.B.	5000-96B	56801

The test was conducted in accordance with FED-STD-101C, Method 5019.1, at ambient temperature.

The container and load was placed on the vibration table (Figure 10). Restraints were utilized that would prevent the container from sliding off the table. The container was allowed about 1/2 inch unrestricted movement in the horizontal direction from the centered position on the table.

The table frequency was increased from 0.0 Hertz (Hz) until the container left the table surface. Test duration was two hours.

At one inch double amplitude, a 1/16 inch thick metal bar could be slid freely between table and the container under all points of the container.

Visual inspection revealed no damage to the container.

TEST SEQUENCE 10 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description except the container was tested without test load).

The container leak rate was 0.049 psi/hr when the container was pressurized to 1.5 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 11 - FED-STD-101C, Method 5016.1, Superimposed-Load Test (Stackability, With Dunnage), MIL-STD-648A, 5.7.2, Load Test (Stack ability) Test, and MIL-C-5584D, 4.7.6.1, Load Resistance.

The following equipment was utilized:

EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER
Forklift Truck 4000 pounds	Mercury	401P	147976

The test was conducted in accordance with FED-STD-101C, Method 5016.1, with the constant "S" = 2.0 for the equation of Paragraph 6.1.

The container containing the load was placed on a flat, level, rigid surface. An extra container was placed upon the test container cover to simulate stacking of like containers. A 3400 pound load (including the extra container) was applied to simulate a stacking load on the container top (Figure 11).

The load remained in place for one hour. A visual inspection of the container was made when the load was removed. No container deformation was noted. The stacking pads restricted relative displacement of the stacked containers.

TEST SEQUENCE 12 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description except the container was tested without test load).

The container leak rate was 0.045 psi/hr when the container was pressurized to 1.5 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 pas/hr (reference Test Plan).

TEST SEQUENCE 13 - Handle Pull Tests (Modified).

The following equipment was utilized:

EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER
Hoist	Coffing	3 Ton	SRD-112-CP
Tie-down Tester	AFPEA	N/A	N/A

TEST SEQUENCE 13A - MIL-STD-648, 5.8.3, Hoisting Fittings Strength Test, MIL-C-5584D, 4.7.4, Handling Provisions Test.

An attempt was made to lift a 750 pound load (including the loaded container) by the container's four manual lift handles. This load represented at least five times the 149.75 pounds gross container weight.

The handles started to deform their handle stops (Figure 12), so the load was reduced to 200 pounds (total weight of 350 pounds). The container was lifted and suspended for 5 minutes with no deformation of the handle stops (Figure 13).

After completion of this test sequence, an attempt was again made to lift the 750 pound load. The container was lifted and suspended with the four handle stops sustaining permanent deformation, but no failure of the handle, nor creation of an unsafe handling condition once deformation had occurred.

The design engineer's intent is that the container will be palletized for unit shipment and that personal would use the manual lift handles to lift no more than two containers at a time. (Limitations based on human factors specifications would be one container.)

TEST SEQUENCE 13B - MIL-STD-648, 5.8.5, Single Hoisting Strength Test, MIL-C-5584D, 4.7.4, Handling Provisions Test.

The loaded container was lifted completely off the ground and suspended for 5 minutes by a manual lift handle (Figure 14). There was no damage or permanent deformation to the handle.

TEST SEQUENCE 13C - MIL-C-5584D, 4.7.4, Handling Provisions Test.

The container was placed on the AFPEA tie-down tester. The minimum required applied force was 250 pounds. A force in excess of this was applied perpendicularly to Side 4 by a hydraulic

cylinder/load cell through a chain looped through the center of a manual lift handle (Figure 15). A force was also applied to the sides of the handle in the direction of Sides 2 and 4 respectively. The test duration was one minute for each force application. There was no damage or permanent deformation to the handle.

TEST SEQUENCE 14 - MIL-C-5584D, 4.7.5.1, Cover Stand Off Test.

The container cover (resting on the container stand offs) was placed on a flat, level, rigid floor. A 15 pound load, representing the container cover weight, was placed on top of the container cover representing a force of two times the container cover weight on the standoffs.

The container cover and load were slid 5 feet across a concrete floor on the container stand offs in four different directions. The container stand offs and gasket sealing area did not deform or sustain damage.

TEST SEQUENCE 15 - MIL-STD-648, 5.5, Structural Integrity.

Reference Test Sequence 4 (Initial test description).

TEST SEQUENCE 15A - MIL-STD-648, 5.5.2, Pressure Test.

The container was pressurized to 3.0 psi. There was no failure of the latches, fasteners, or container structure.

TEST SEQUENCE 15B - MIL-STD-648, 5.5.3, Vacuum Test.

The container was evacuated to -3.0 psi. There was no failure of the latches, fasteners, or container structure.

TEST SEQUENCE 16 - MIL-C-5584D, 4.7.7.2.5, UN Drop Test.

Reference Test Sequences 5 and 7 (Initial test description).

The container and test load were dropped 47.2 inches onto the drop tester steel plate at ambient temperature. One flat drop was made on sides 3, 1, 6, and 2. A drop was made on corner 146 (Figure 16). The same container was used for all drops. There was no spillage of the container contents.

APPENDIX A

PHOTOGRAPHS

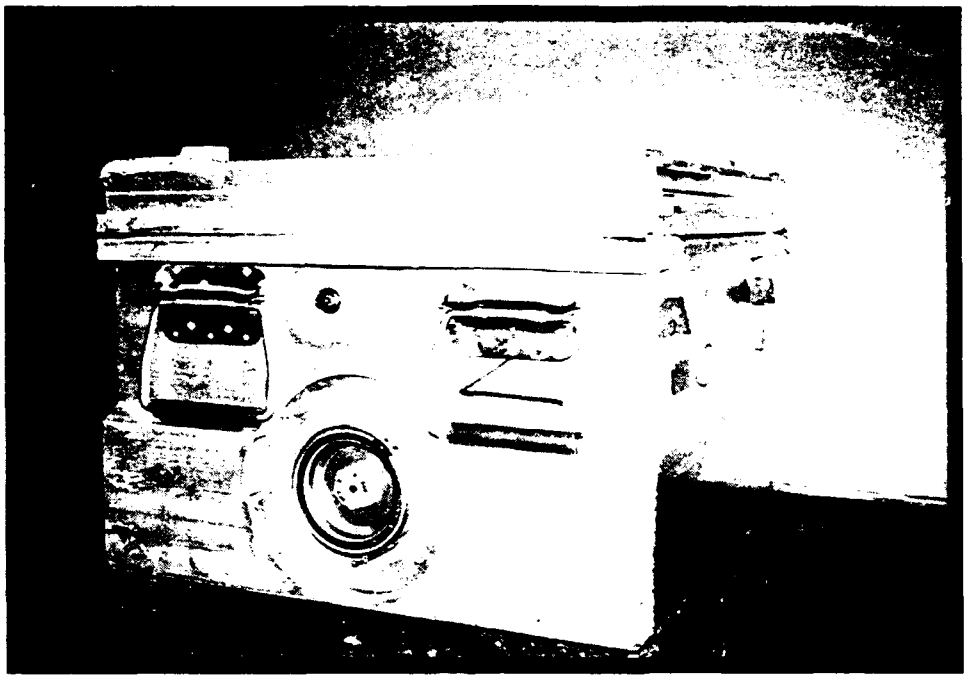

Figure 1. CNU-533/E - Container.

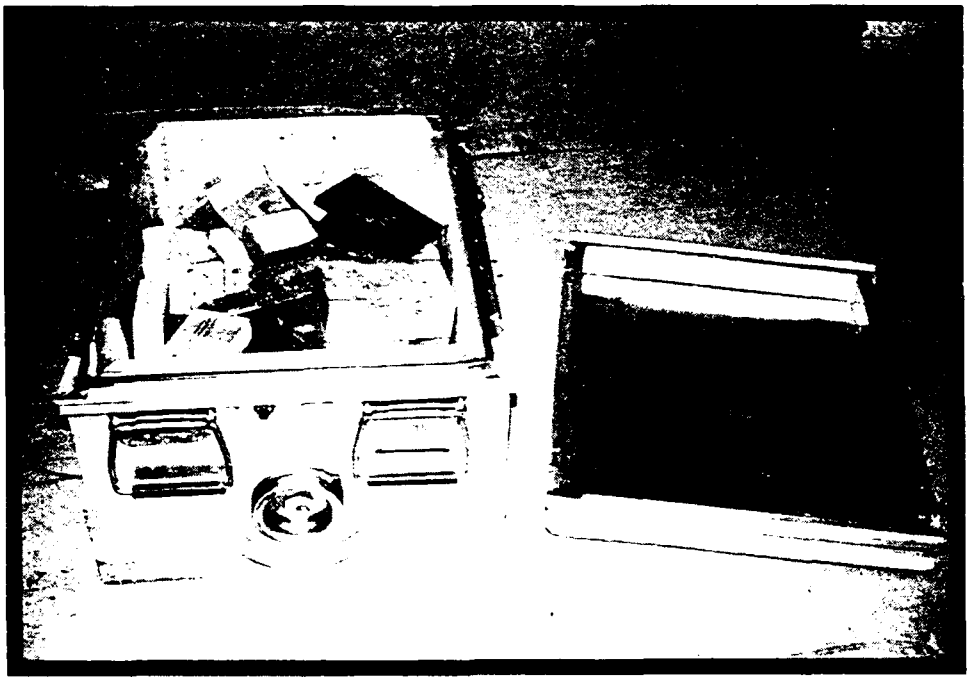

Figure 2. CNU-533/E - Container and Base.

Figure 3. Container as Tested.

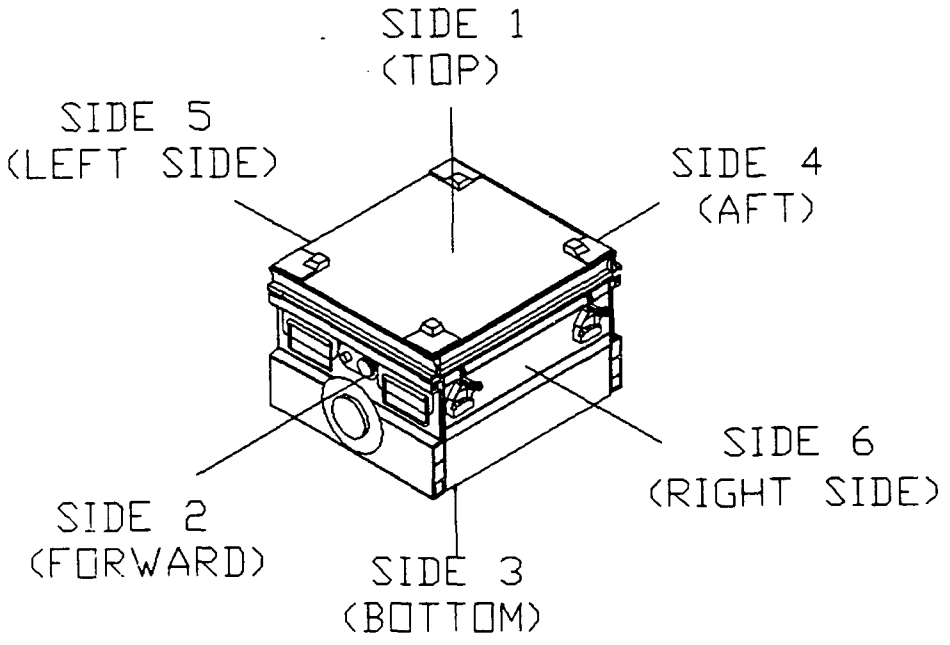

Figure 4. Container Side Designations.

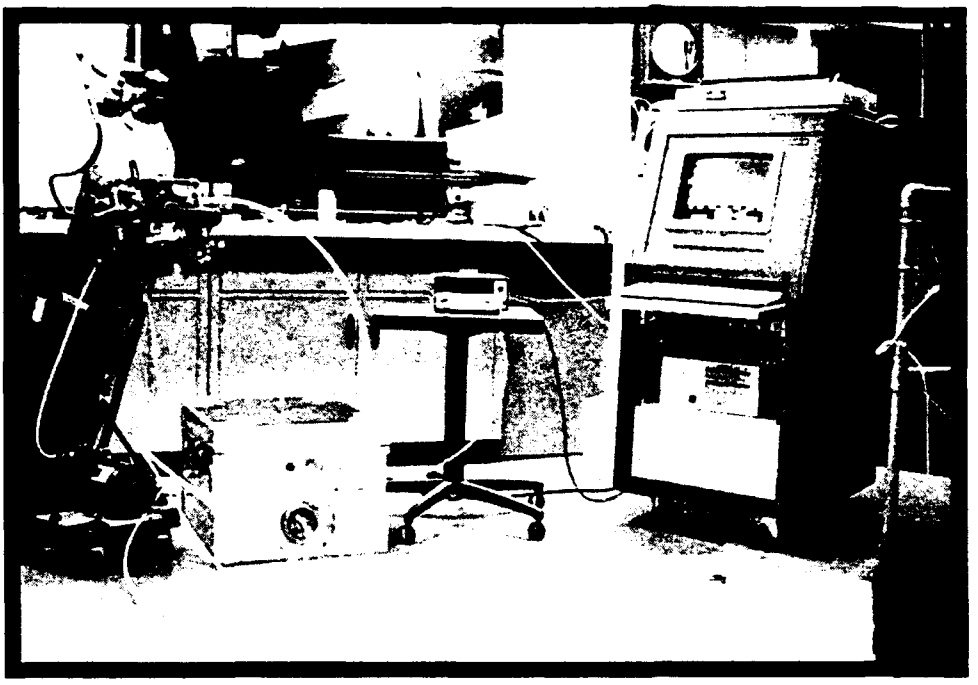

Figure 5. Pneumatic Pressure/Vacuum Retention Leak Test

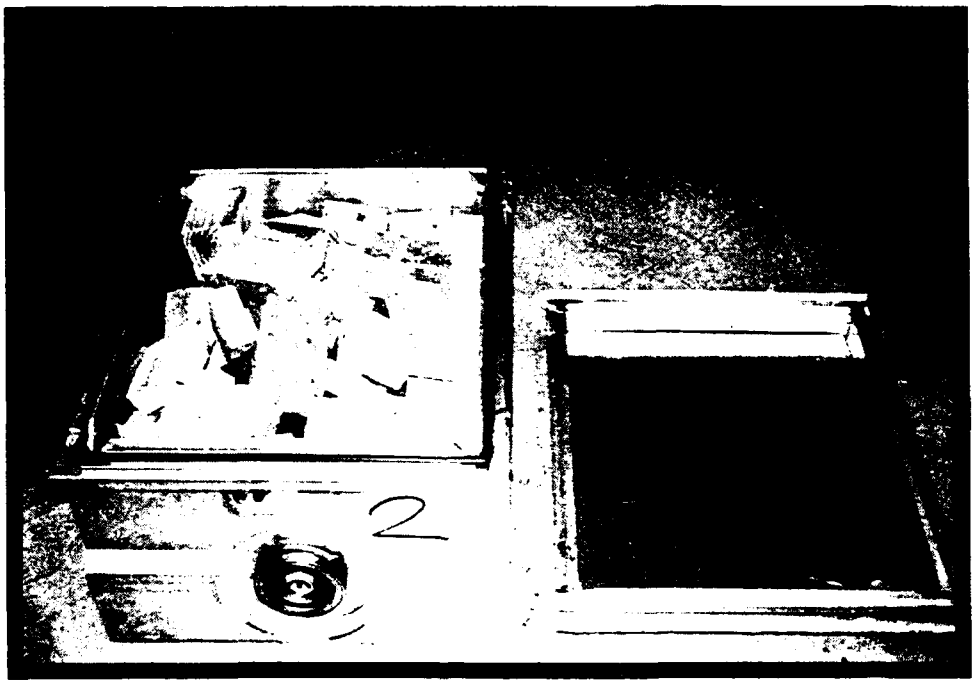

Figure 6. Container and Test Load.

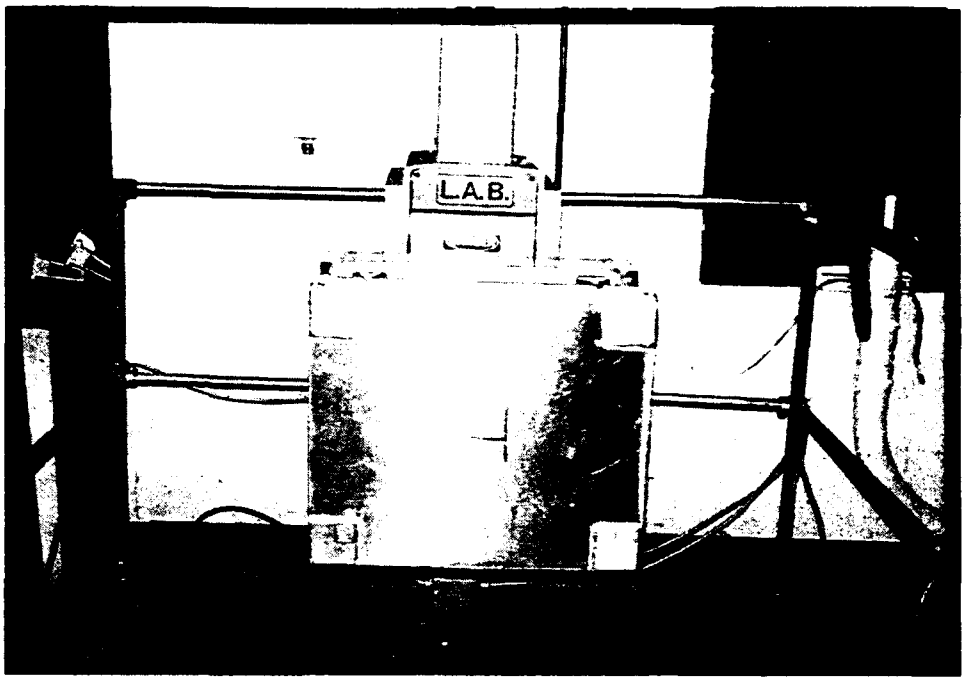

Figure 7. Free Fall Drop Test - Flat Face Drop Test.

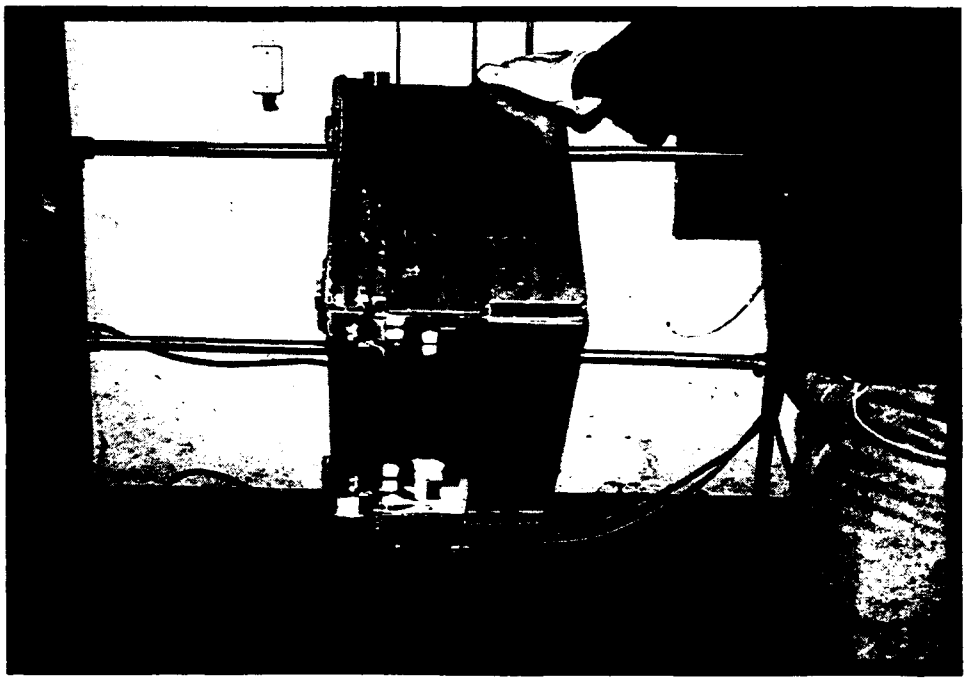

Figure 8. Free Fall Drop Test - Edgewise-Drop Test.

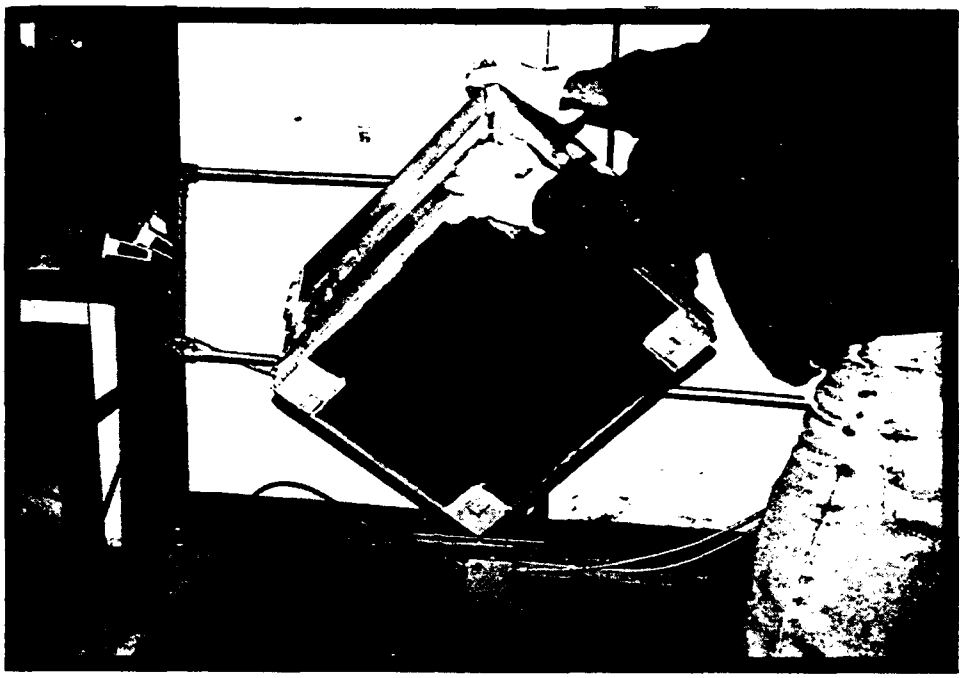

Figure 9. Free Fall Drop Test - Cornerwise-Drop Test.

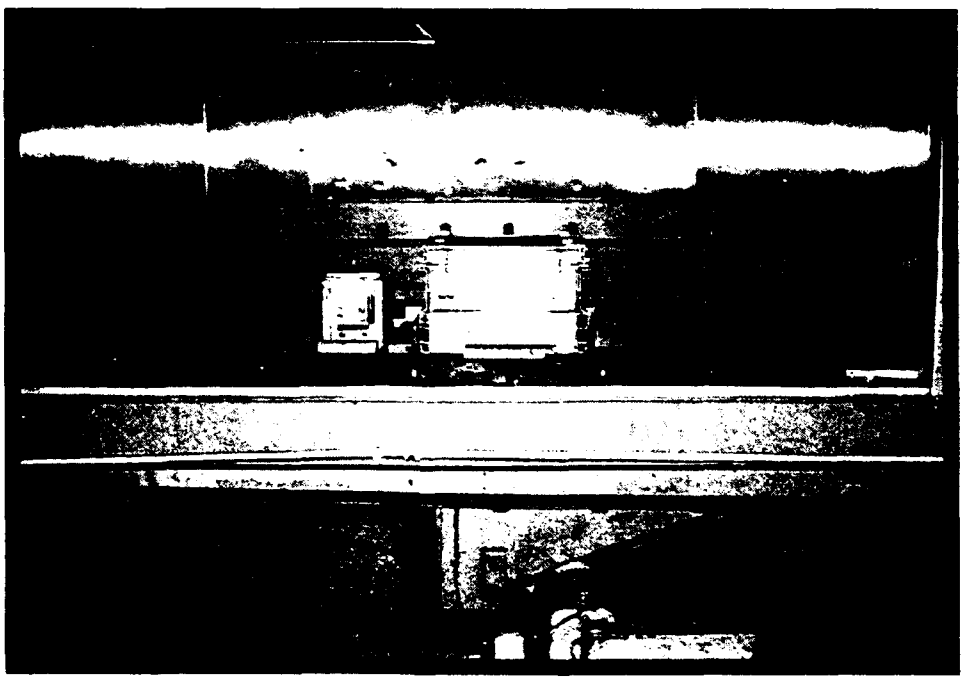

Figure 10. Repetitive Shock Test.

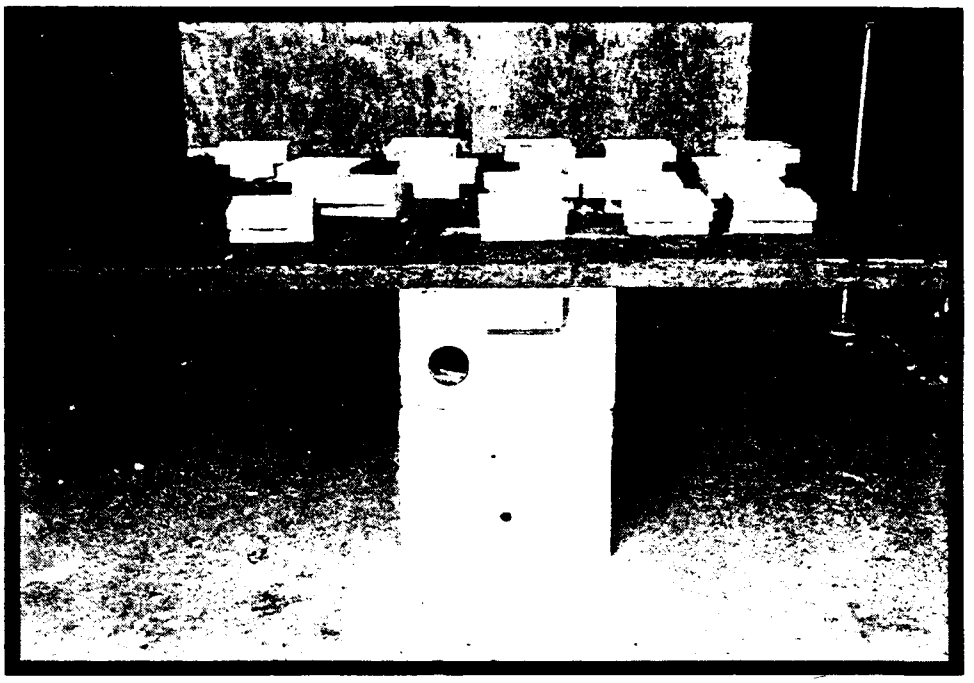

Figure 11. Superimposed Load Test - Stackability With Dunnage.

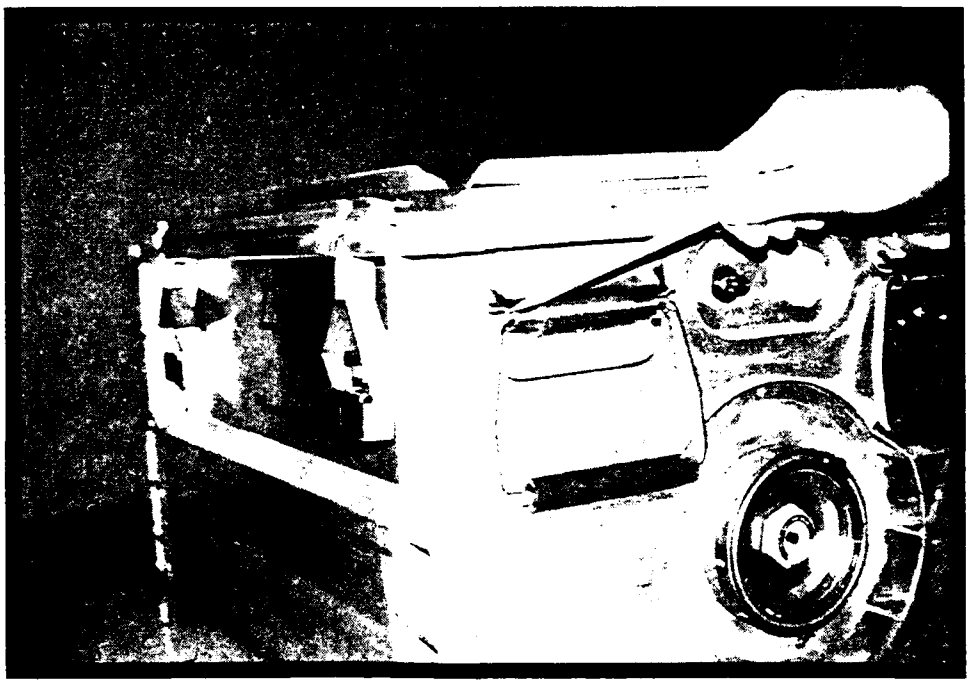

Figure 12. Handling Provisions Test
Deformation of Handle Straps.

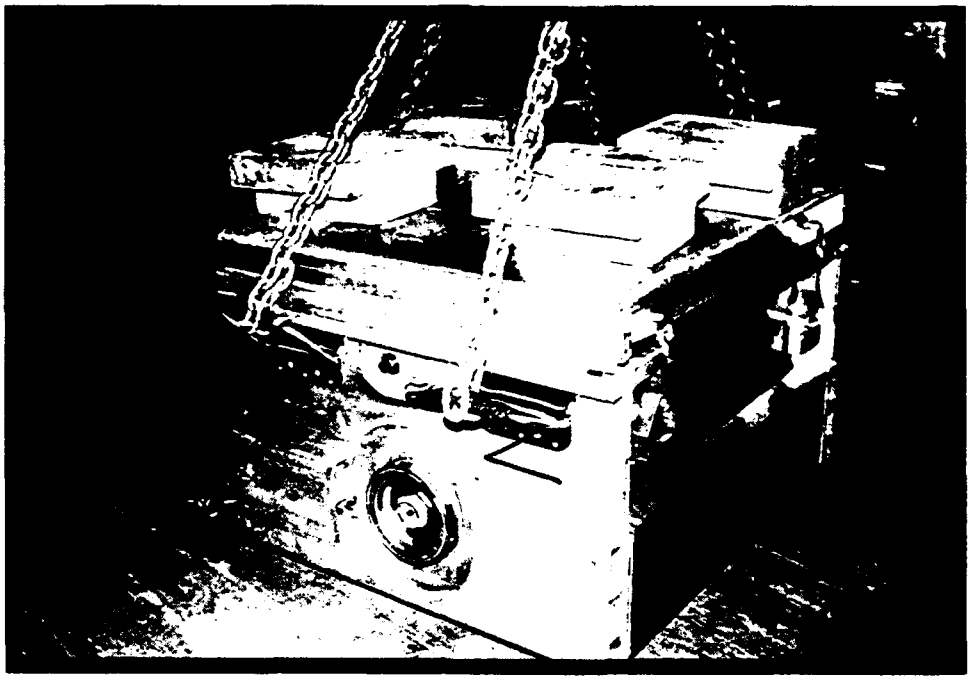

Figure 13. Handling Provisions Test.

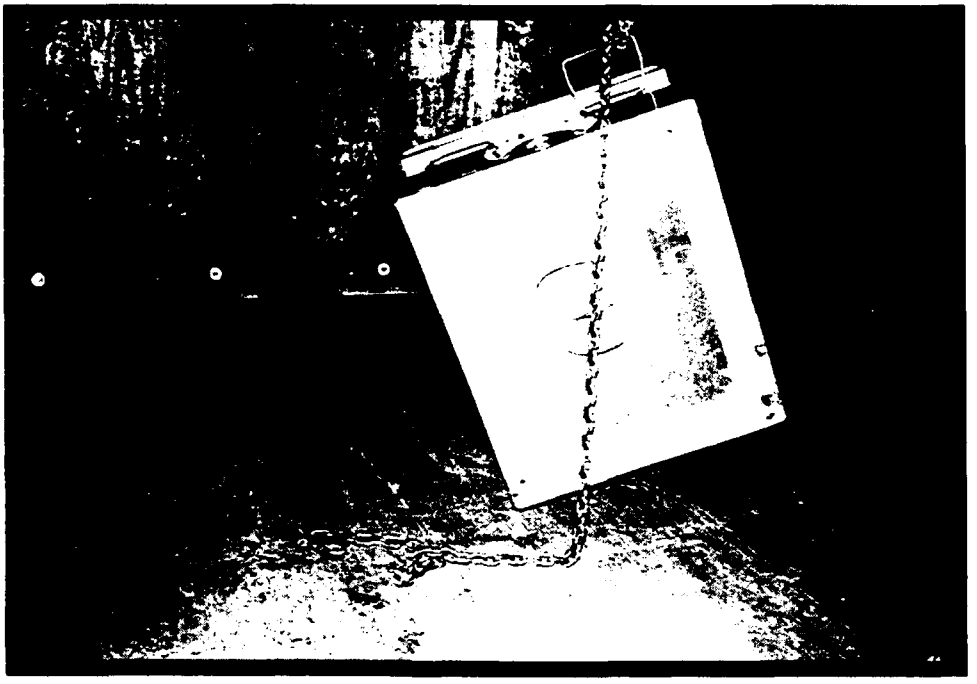

Figure 14. Single Hoisting Strength Test.

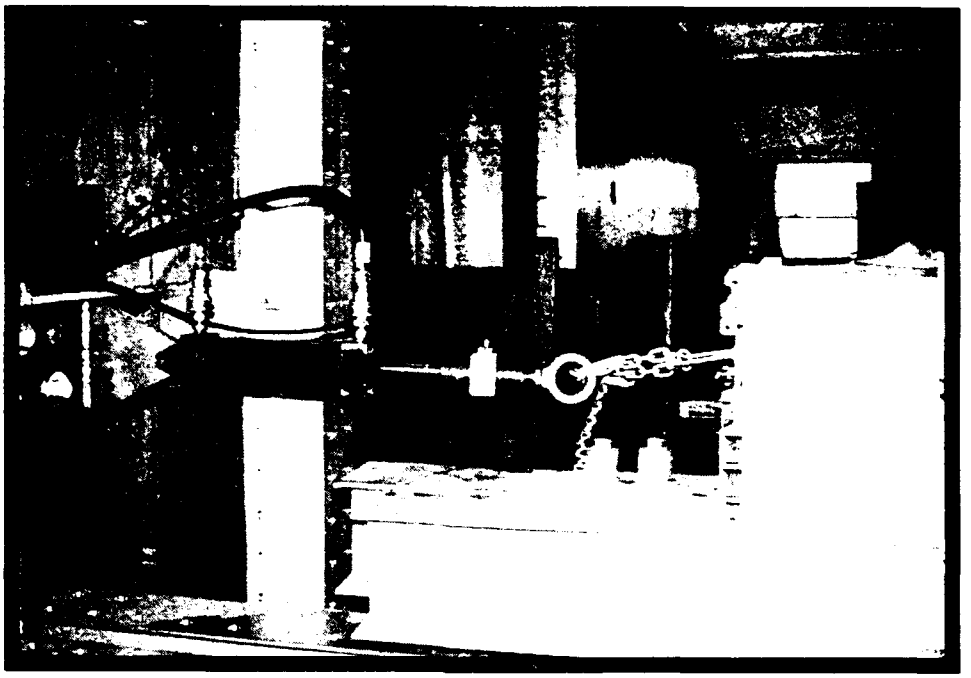

Figure 15. Handle Pull Test.

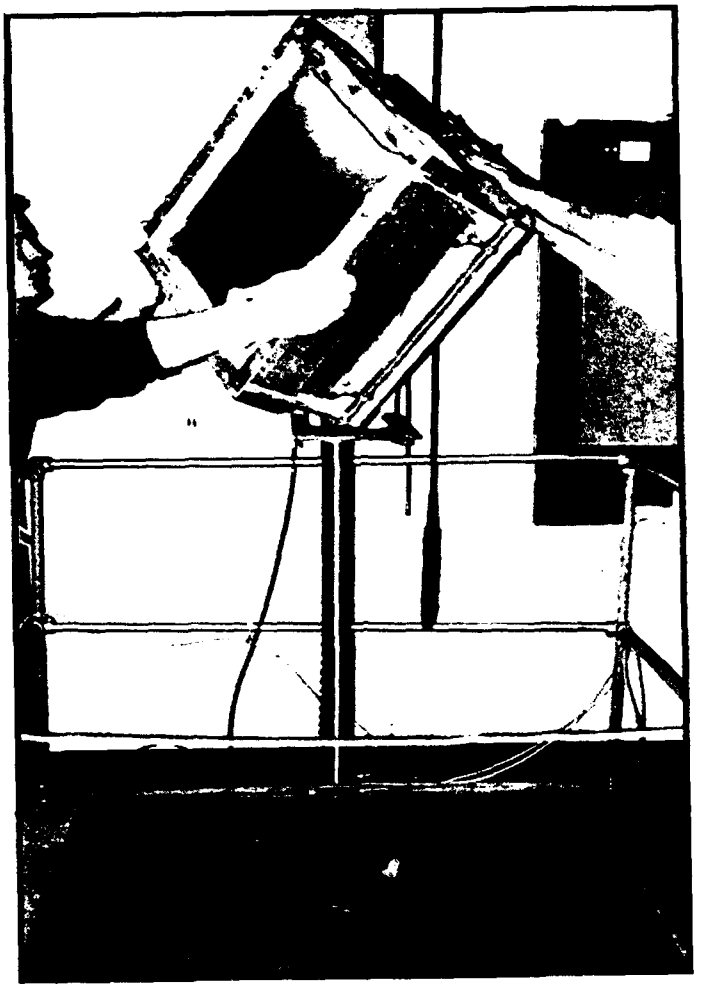

Figure 16. UN Drop Test.

APPENDIX 4

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APPENDIX 5

REPORT DOCUMENTATION

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	October 94	Final 10 Jan 91 - Oct 94

4. TITLE AND SUBTITLE

Development of the Family of Munitions Container #2 for Small Miscellaneous Munitions CNU 533/E

5. FUNDING NUMBERS

6. AUTHOR(S)

Robert S. Tekesky

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

AFMC - LSO/LGTPD
Packaging Branch
5215 Thurlow St BLDG 70
Wright-Patterson AFB OH 45433-5540

8. PERFORMING ORGANIZATION REPORT NUMBER

94-R-01

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

DISTRIBUTION UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This report is to document the design and qualification testing of a aluminum container, CNU 533/E, for shipping/storing of fuses, boosters, and other miscellaneous munitions. The CNU 533/E is a welded aluminum, controlled breathing reusable container. The container is a two person carry with a gross weight of 150 lbs. This container was designed to fulfill a Productivity, Reliability, Availability, Maintainability (PRAM) project 21989-01 suggestion.

14. SUBJECT TERMS

CNU 533/E, Munitions Container, Aluminum Container, Reusable Container, Design, Test, Container

15. NUMBER OF PAGES

40

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL